

SILVER



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SILVER

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**GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES**

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15 Silver

Silver is soft and lustrous metal that is grouped in the category of noble metals. Its brilliant white colour, malleability and resistance to atmospheric oxidation has enhanced its value as a highly desired precious metal which is used in many industrial applications. Apart from its monetary and decorative uses, silver is known to have the highest electrical conductivity amongst all metals that enhances its potential in modern age applications, viz, for printed electric circuits, coating for electronic conductors and in alloys of gold & copper for electrical contacts. Its chloride and iodide are light-sensitive and hence used in photographic material. Silver is typically used (in paste form) on solar cells, this means the photovoltaics (PV) market has become one of the most important areas of silver demand. These two major uses have contributed to the increase in supply of scrap of silver contained products. Silver, which is the least expensive of the precious metals, is the whitest element and has the highest electrical and thermal conductivity among all the metals.

In India, there are no native silver deposits except the small and unique Bharak deposit in Rajasthan. It occurs generally with lead, zinc, copper (especially their sulphide ore) and gold ores and is extracted as a by-product from electrolysis or chemical methods. It was usually extracted by melting silver-bearing lead ore (ore containing argentiferous galena).

Silver is recovered as a co-product as well as a by-product in the country. Silver was recovered in the past as a co-product in gold refining at KGF Complex and Hutti Gold Mines in Karnataka and as a by-product in smelting and refining of lead, zinc and copper concentrates at Chanderiya and Debari smelters in Rajasthan, Tundoo and Moubandar (Ghatsila) smelters in Jharkhand and at Visakhapatnam smelter in Andhra Pradesh. The present production of silver comes from Chanderiya lead-zinc smelter of HZL and from gold refinery of HGML.

In addition, Hindalco extracts silver as a by-product during smelting of imported copper concentrates at Dahej in Gujarat.

RESERVES/RESOURCES

As per the NMI database, based on UNFC system, the total reserves/resources of silver ore in the country as on 1.4.2015 have been estimated at about 511.95 million tonnes. Out of these, 150.44 million tonnes were placed under 'Reserves' category and 361.51 million tonnes under the 'Remaining resources' category.

The total reserves/resources of silver in the country as on 1.4.2015 in terms of metal content were estimated at 29,982 tonnes, of which 7,172 tonnes are under 'Reserves' and 22,810 tonnes are under the 'Remaining resources'.

By States, Rajasthan accounted for about 87% reserves/resources in terms of ore, Jharkhand 5%, Andhra Pradesh 3% and Karnataka 2%. Madhya Pradesh, Uttarakhand, Odisha, Meghalaya, Sikkim, Tamil Nadu and Maharashtra together shared 3% ore reserves/remaining resources (Table 1).

As per reserves & resources summary of HZL 2016-17, grade of silver was 93 gram/tonne under reserves category and 74 gram/tonne under resources category.

PRODUCTION

Silver is recovered as a by-product from lead & zinc concentrates, copper slime and as a co-product of gold refining.

As per Annual Report of HZL 2016-17, silver refining capacity was 518 tonnes per annum. The annual total production of refined silver during the year 2016-17 was 480 tonnes under total refined metal. HZL also has facilities at Pantnagar, in the State of Uttarakhand for processing and refining of silver. This facility does not add to the overall smelting capacity.

**Table – 1 : Reserves/Resources of Silver as on 1.4.2015
(By Grades/States)**

(In tonnes)

State/Grade	Reserves			Remaining Resources					Total Resources (A+B)	
	Proved STD111	Probable STD121 STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221 STD222	Measured STD331	Indicated STD332	Inferred STD333		Reconnaissance STD334
All India : Total										
Ore	69277075	8413000 72753828 150443903		-	1484543 46726460 29632000	65056000	218611729	-	361510732	511954635
Metal	4309.78	220.77 2641.39 7171.94		-	42.85 259.62 2037.99	3236.39	17230.19	2.84	22809.88	29981.82
By state										
Andhra Pradesh										
Ore	-	-	-	-	-	16950000	-	-	-	16950000
Metal	-	-	-	-	-	128.13	-	-	-	128.13
Jharkhand										
Ore	-	-	-	-	-	-	23840000	-	23840000	23840000
Metal	-	-	-	-	-	-	5.22	-	5.22	5.22
Karnataka										
Ore	10620000	1730000	12350000	-	69462	-	314150	-	383612	12733612
Metal	2.71	0.24	2.95	-	0.48	-	2.92	-	3.40	6.35
Madhya Pradesh										
Ore	-	-	-	-	-	2096000	1120000	-	3216000	3216000
Metal	-	-	-	-	-	150.61	9.25	-	159.86	159.86
Maharashtra										
Ore	-	-	-	-	-	-	235000	-	235000	235000
Metal	-	-	-	-	-	-	0.23	-	0.23	0.23
Meghalaya										
Ore	-	-	-	-	-	880000	-	-	880000	880000
Metal	-	-	-	-	-	19.80	-	-	19.80	19.80

(Contd.)

Table - 1 (Concl.d.)

State/Grade	Reserves				Remaining Resources				Total Resources (A+B)	
	Proved STD111	Probable		Feasibility STD211	Pre-feasibility STD221	Measured STD331	Indicated STD332	Inferred STD333		Reconnaissance STD334
		STD121	STD122							
Odisha										
Ore	-	-	-	960500	119000	-	-	670000	-	1749500
Metal	-	-	-	27.34	3.40	-	-	34.17	-	64.91
Rajasthan										
Ore	58657075	6683000	72753828	138093903	-	88200	29524218	27732000	60350000	191432579
Metal	4307.07	220.53	2641.39	7168.99	-	0.26	127.57	1876.39	3045.91	17137.53
Sikkim										
Ore	-	-	-	-	-	435843	63780	300000	-	150000
Metal	-	-	-	-	-	15.25	0.04	27.60	-	13.80
Tamil Nadu										
Ore	-	-	-	-	-	-	-	330000	460000	790000
Metal	-	-	-	-	-	-	-	15.87	26.68	42.55
Uttarakhand										
Ore	-	-	-	-	-	-	-	1600000	1400000	3900000
Metal	-	-	-	-	-	-	-	134.00	4.20	138.59

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Ore	-	-	-	-	-	949623	-	949623	-	949623
Metal	-	-	-	-	-	56.69	-	56.69	-	56.69
Tamil Nadu										
Ore	-	-	-	-	-	-	-	790000	-	790000
Metal	-	-	-	-	-	-	-	42.55	-	42.55
Uttarakhand										
Ore	-	-	-	-	-	-	-	3390000	-	3390000
Metal	-	-	-	-	-	-	-	138.59	-	138.59

Figures rounded off.

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Table – 2 : Principal Producers of Silver, 2016-17

Name and address of the producer	Name of Plant	Location of the plant	
		State	District
Hindustan Zinc Ltd, Yashad Bhavan, Udaipur- 313 004 Rajasthan.	Chandera	Rajasthan	Chittorgarh
The Hutti Gold Mines Co. Ltd, Hutti, Distt.-Raichur, 584 115 Karnataka	Hutti	Karnataka	Raichur

**Table – 3 : Production of Silver*, 2014-15 to 2016-17
(By States)**

(Quantity in kg; Value in `'000)

State	2014-15		2015-16		2016-17 (P)	
	Qty	Value	Qty	Value	Qty	Value
India	327647	11947028	426443	15212374	460811	18320759
Karnataka	139	5103	122	4048	169	6640
Rajasthan	327508	11941925	426321	15208326	460642	18314119

*: Excludes by-product recovery of silver by Hindalco Industries Ltd at Dahej, Gujarat from imported copper concentrates.

**Table – 4 : Production of Silver*, 2015-16 and 2016-17
(By Sectors/States/Districts)**

(Qty in kg; Value in `'000)

State/District	2015-16		2016-17 (P)	
	Qty	Value	Qty	Value
India	426443	15212374	460811	18320759
Public sector	122	4048	169	6640
Private sector	426321	15208326	460642	18314119
Karnataka/Raichur	122	4048	169	6640
Rajasthan/Chittorgarh	426321	15208326	460642	18314119

*: Silver as a by-product:

i) In Karnataka, it is recovered at Raichur while refining of gold at Hutti and Uti gold mines.

ii) In Rajasthan, it is recovered at Chandera, lead-zinc smelters of HZL.

iii) Excludes by-product recovery of 64,735 kg and 67,063 kg silver from imported copper concentrates in 2015-16 and 2016-17, respectively.

During the year 2016-17, the production of silver at 4,60,811 kg increased by 8% as compared to the previous year. The production of silver from gold refining was 169 kg in 2016-17 as against 122 kg in 2015-16. One Private Sector and one Public Sector Undertaking reported production of silver during 2016-17 (Tables- 2 to 4).

In addition, Hindalco Industries Limited reported production of 64,735 kg and 67,063 kg silver from

imported copper concentrates in 2015-16 and 2016-17 respectively.

TRADING EXCHANGE

The three leading commodities exchanges, where a prospective investor can trade in silver are:

1. National Multi Commodity Exchange (NMCE)
2. National Commodity & Derivatives Exchange (NCDEX)
3. Multi Commodity Exchange (MCX)

RECYCLING

Recycling, a significant factor in the supply of many of the metals used in our society, provides environmental benefits, such as, energy saving, reduced emission associated with energy saving etc. Photographic wastes, spent catalysts and electronic scrap are the major sources of materials for silver recycling. Other recyclable silver-bearing materials include dental alloys, jewellery and silverware. Cell phones have become one of the major sources for recycled silver recovery.

As per USGS Report entitled "Recycled Cell Phones—A Treasure Trove of Valuable Metals", references on data offered by the Falconbridge Ltd, indicate that one tonne of obsolete cellphones (exclusive of batteries) contains an average 3.14 kg of silver metal. As per the data of World Silver Survey 2017, silver scrap supply remains steady at 85 tonnes (2.7 Moz) in 2016 as compared to the previous year. Scrap from retail consumers was mainly in the form of old jewellery. Recycling of silver from these uses is an important part of its supply.

As per annual Silver Focus Report 2017, global silver recycling was effectively unchanged during 2016-17, at 5,023 tonnes (161.5 Moz). The largest source of silver scrap, which is the Industrial Sector, posted a 1% rise, benefitting from slightly higher ethylene oxide recycling.

This was joined by a 4% gain for jewellery, the result of growth in East Asia and the Middle East. However, these were offset by losses elsewhere. Photographic recycling posted a further structural decline and the largest year to year fall at 7%. By contrast, silverware fell by 3%, in large part due to the weak response from western countries scrap to higher prices.

As per Mineral Commodity summaries, 2018 approximately 1,150 tonnes of silver was recovered from new and old scrap in United State of America during 2016-17.

WORLD REVIEW

The total reserves of silver in metal content are estimated at 5,30,000 tonnes. Peru contributed (18%), Australia & Poland (17% each), Russia (10%), China & Mexico (7% each) and Chile (5%) are the major countries having silver reserves (Table-5).

Mexico, Peru, China, Australia, Russia, Bolivia and Poland are the main producers of

silver. The global primary as well as by-product mine output slightly increased to 27,511 tonnes of metal content in 2015 from 27,203 tonnes in the previous year. The total world mine production of silver in metal content was reported at 27.46 thousand tonnes during the year 2016 which is slightly lower by 1% as compared to 27.84 thousand tonnes in the preceding year. Mexico was the leading producer by contributing (20%) share in the total production followed by Peru (16%), China (13%), Australia, Bolivia, Chile, Poland and Russia (5% each), Kazakhstan (4%). World mine production of silver is furnished in Table- 6.

**Table – 5 : World Reserves of Silver
(By Principal Countries)**

(In tonnes of silver content)	
Country	Reserves
World: Total (rounded)	530000
Australia	89000
Bolivia	22000
Chile	27000
China	39000
Mexico	37000
Peru	93000
Poland	89000
USA	25000
Russia	55000
Other countries	57000

Source: Mineral Commodity Summaries, 2018. USGS

**Table – 6 : World Mine Production of Silver
(By Principal Countries)**

(In tonnes of metal content)			
Country	2014	2015	2016
World: Total	27477	27839	27461
Argentina	905	1079	933
Australia	1847	1430	1418
Bolivia	1345	1306	1353
Canada	495	384	405
Chile	1572	1504	1501
China	3673	3421	3496
Guatemala	858	863	838
India	328	426	461
Kazakhstan	989	1309	1176
Mexico	5766	5955	5409
Peru	3778	4102	4375
Poland	1384	1407	1482
Russia ^a	1434	1580	1449
Sweden	383	480	499
USA	1184	1090	1100 ^c
Other countries	1536	1502	1565

*Source: World Mineral Production, 2012-2016. BGS
a :- Smelted and/or refinery production.*

Australia

Production in Australia decreased by 26% to 1,374 tonnes in 2015 from 1,847 tonnes in 2014. The decrease was the result of lower average ore grades which is in tandem and in accord with plans to cease operation at Cannington in 2015.

Argentina

Silver production increased by 19% to 1,079 tonnes in 2015 from 905 tonnes in 2014 owing to production increases at most of the major silver mines and to the startup of Goldcorp Inc.'s Cerro Negro Mine. Processing of ore at Cerro Negro commenced in July and began ramping up to full capacity of 4,000 tonnes per day of ore. Significant increases in silver production took place at Pan American Silver Corp.'s Manantial Espejo Mine and Troy Resources Ltd's Casposo Mine.

Chile

Silver production decreased by 4% to 1,504 tonnes in 2015 from 1,572 tonnes in 2014.

FOREIGN TRADE

Exports

Exports of metal silver increased marginally by 17% to 28 tonnes in 2016-17 as compared to 24 tonnes in the preceeding year. Exports were mainly to USA (57%) and UAE (14%) (Table-7). There were no exports of silver ores and concentrate during 2015-16 & 2016-17. Exports of silver-clad base metals was drastically increased almost thirteen times to 4,049 kg during 2016-17 from 291kg reported in 2015-16. Exports of Semi-Manufactured silver were at 27 tonnes during the year 2016-17 as compared to 24 tonnes in the previous year. Exports of silver-unwrought & silver powder was negligible in both the year (Tables-7 to 11).

Imports

Imports of silver decreased drastically by 55% to 3,359 tonnes in 2016-17 as compared to 7,428 tonnes in the preceding year. Imports were mainly from the Hong Kong (25%), China (24%), Korea, Rep. of (11%), Russia (10%), UK & Switzerland (6% each) and Germany (4%).

Imports of silver-clad base metals were at 138 kg in 2016-17 as against 189 kg in the previous year. USA (59%), Portugal (22%) and UK (15%) were the major importers.

Imports of Semi-Manufactured silver were at 373 tonnes during the year 2016-17 as compared to 502 tonnes in the previous year. Besides, imports of Silver unwrought were 2,971 tonnes during the year 2016-17 as compared to 6,784 tonnes in previous year. Hong Kong (27%), China (24%), Korea, rep. of (12%), Russia (11%) and UK (7%) were the major importers. Imports of silver powder in 2016-17 decreased drastically by 89% to 15 tonnes from 142 tonnes reported in the previous year. Switzerland was the sole importer country (Tables-12 to 16).

Table – 7 : Exports of Silver (By Countries)

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	24	481460	28	756462
USA	14	191372	16	330899
UAE	2	112351	4	208431
Mexico	1	28650	1	32295
Canada	2	23381	1	27766
Philippines	1	10765	1	16696
Finland	++	7285	1	14708
UK	++	14105	++	14656
Poland	++	781	++	13271
Italy	++	3089	1	13190
Slovenia	++	6553	++	7740
Other countries	4	83128	3	76810

Table – 8 : Exports of Silver-clad Base Metals (By Countries)

Country	2015-16 (R)		2016-17 (P)	
	Qty (kg)	Value (` '000)	Qty (kg)	Value (` '000)
All Countries	291	2514	4049	11141
Sri Lanka	100	231	4046	11134
Philippines	-	-	2	5
Australia	-	-	1	2
USA	190	2267	-	-
Cyprus	1	16	-	-

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**Table – 9 : Exports of Silver:Semi-Manufactured
(By Countries)**

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	24	461664	27	731480
USA	14	185000	15	310726
UAE	2	111297	4	208428
Mexico	1	28650	1	32295
Canada	2	23381	1	27766
Philippines	1	10765	1	16696
Finland	++	7285	1	14708
UK	++	3632	++	14656
Poland	++	781	++	13271
Italy	++	3089	1	13151
Slovenia	++	6553	++	7740
Other countries	4	81231	3	72043

**Table – 10 : Exports of Silver:Unwrought
(By Countries)**

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	++	19777	1	20425
USA	++	6372	1	20173
Malaysia	++	96	++	120
UK	++	10473	-	-
UAE	++	1054	-	-
Germany	++	508	-	-
Hong Kong	++	507	-	-
Belgium	++	400	-	-
Dominican Rep.	++	286	-	-
Saudi Arabia	++	81	-	-
Other countries	-	-	++	132

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**Table – 11 : Exports of Silver:Powder
(By Countries)**

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	++	19	++	4557
Austria	-	-	++	3472
Chinese Taipei/Taiwan	-	-	++	845
Spain	-	-	++	184
Italy	-	-	++	39
Morocco	-	-	++	14
UAE	-	-	++	3
Sri Lanka	++	10	-	-
Singapore	++	8	-	-
Tanzania	++	1	-	-

**Table – 12 : Imports of Silver
(By Countries)**

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	7428	244357988	3359	123293266
Hong Kong	252	8221064	836	32082324
China	775	25124810	793	29565386
Korea, Rep. of	533	17373285	366	12885781
Russia	713	22665591	321	11575782
UK	2336	75325344	216	7519006
Switzerland	967	31502018	199	7110228
Germany	258	8246166	136	4846793
USA	352	11352603	96	3457490
Singapore	13	414599	76	2941926
Poland	100	3265689	81	2709771
Other countries	1129	40866819	239	8598779

**Table – 13 : Imports of Silver-clad Base Metals
(By Countries)**

Country	2015-16 (R)		2016-17 (P)	
	Qty (kg)	Value (` '000)	Qty (kg)	Value (` '000)
All Countries	189	1185	138	2964
USA	-	-	82	1323
UK	-	-	21	1027
Portugal	-	-	30	474
France	-	-	5	140
Germany	39	940	-	-
Korea, Rep. of	150	245	-	-

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**Table – 14 : Imports of Silver Semi-Manufactured
(By Countries)**

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	502	15596906	373	12741317
China	54	1777202	69	2555388
Poland	++	1146	60	2029970
Germany	1	34110	42	1469344
Hong Kong	2	59631	34	1285709
Singapore	6	196799	30	1167076
Switzerland	33	1050492	30	1034868
USA	51	1298605	34	832273
Korea, Rep. of	153	4980433	18	611980
South Africa	15	459534	15	573415
Italy	26	417385	25	456359
Other countries	161	5321569	16	724935

**Table – 15 : Imports of Silver :Unwrought
(By Countries)**

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	6784	224242896	2971	109940647
Hong Kong	250	8161433	802	30793596
China	711	23024854	724	26993733
Korea, Rep. of	345	11218404	348	12273801
Russia	701	22302871	319	11521241
UK	2202	71057608	215	7460708
Switzerland	900	29361135	154	5517139
Germany	257	8206831	94	3371038
USA	300	10021484	62	2605178
Singapore	6	202407	46	1774850
Chinese Taipei/Taiwan	198	6314698	36	1321691
Other countries	914	34371171	171	6307672

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**Table – 16 : Imports of Silver :Powder
(By Countries)**

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	142	4518186	15	611302
Switzerland	34	1090391	15	558221
USA	1	32514	++	20039
China	10	322754	++	16265
Germany	++	5225	++	6411
Hong Kong	-	-	++	3019
Israel	++	2821	++	3006
Chinese Taipei/Taiwan	++	850	++	2622
Italy	++	2385	++	1192
Malaysia	-	-	++	500
UK	53	1648198	++	27
Other countries	44	1413048	-	-

FUTURE OUTLOOK

Silver has the dual usefulness of being a precious metal as well as an industrial metal. World over, silver is primarily traded for its industrial applications, however, Indian silver imports are largely consumed for jewellery and silverware. India is among the top 5 silver consumers in the world. About 60% of silver consumption in India is from the rural population who view it as a solid saving commodity. India does not produce silver in a significant scale and most of the silver has to be imported. Moreover, silver demand has been on the rise in major growing economies including India during the past few years. New industries, such as, medicine, manufacturing etc. are sealing up their demand for silver, and this may soon translate to higher levels of imports.

As per Annual Silver Focus Report 2017, global silver demand in photographic applications is likely to drop and is expected to touch 1,155 tonnes (37.1 Moz) during 2017-18. Digital technology and its applications would indeed be the primary cause for this fall.

As per Annual Silver Focus Report 2017, India is aiming to double its installation of new capacity from 4.5 GW during 2016-17 to around 10 GW during

2017-18. In the year 2017-18, India in all probabilities would overtake Japan as the world's third largest photovoltaic (PV) market as there are plans to raise capacity steadily to a target of 100 GW by 2022.

On the other side, industrial demand for silver in India may remain unchanged and would be in consistant with 1,015 tonnes (35.8 Moz) as in 2015-16. This trend is likely to continue into the near future. The key areas of industrial demand are electrical and electronics and brazing alloys. The government's aggressive effort to boost infrastructure that include expanding the power network, with a target to complete electrification of villages in the next 4-5 years would be the most potent driving force that would influence the industrial demand for silver.

However, the counter narrative is that notwithstanding the Government's initiative for infrastructural boost, the benefits for industrial demand would be only to modest levels as the high inventory levels of semi-fabricated products across the supply chain would offset any demand escalation of silver. Housing projects (driven by a new government initiative) is another potential demand escalator for electrical equipment which would in turn influence the demand for silver.